EFFECTIVENESS OF EXERGAME ON EXECUTIVE FUNCTION OF AUTISTIC CHILDREN

A PROJECT WORK SUBMITTED IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF OCCUPATIONAL THERAPY

(ADVANCED O.T. IN PAEDIATRICS)

Submitted by

Reg. No. 411513054

JKK MUNIRAJAH MEDICAL RESEARCH FOUNDATION COLLEGE

OF OCCUPATIONAL THERAPY

KOMARAPALAYAM - 638183

Affiliated to

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY,

CHENNAI-600032

APRIL – 2017

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PRINCIPAL EXTERNAL EXAMINER

GUIDE INTERNAL EXAMINER

CERTIFICATE

This is to certify that the Project work entitled **"EFFECTIVENESS OF EXERGAME ON EXECUTIVE FUNCTION OF AUTISTIC CHILDREN"** is a bonafied compiled work carried out by **Reg. No. 411513054,** Final Year student, College of Occupational Therapy under JKK Munirajah Medical Research Foundation, Komarapalayam – 638183, in partial fulfillment for the award of Degree of **"Master of Occupational Therapy"** (Advanced O.T. in Paediatrics) of The Tamil Nadu Dr. M.G.R. Medical University, Chennai-32. This work was guided and supervised by **Mr. T. JEGADEESAN. M.O.T., M.Sc.,(Psy)** at the **Department of Occupational Therapy**, JKKMMRF, Komarapalayam.

Mr. T. JEGADEESAN. M.O.T., M.Sc (Psy)
Principal
JKKMMRF College of Occupational Therapy,
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ABSTRACT

AIM

The purpose of this study is to determine the Effectiveness of Exergame (Modified makoto arena) on Executive function of Autistic children.

METHODS

Totally 30 subjects, 15 in experimental group and 15 in control group with the age of 5-10 years participated in the study.

RESULTS

Statistical significance is present in experimental group than control group with regard to effectiveness of Exergame (Modified makoto arena) with Occupational Therapy intervention.

CONCLUSION

Exergame (Modified makoto arena) has a significant effect in improving Executive function of Autistic children.

KEYWORDS

Autism, Executive function, Exergame (Modified makoto arena), Occupational therapy intervention.

INTRODUCTION

Autism is a pervasive developmental disorder that involves abnormal development and function of the brain and it is present from early childhood characterized by great difficulty in communicating and forming relationships with other people and in using language and abstract concepts.

Global Burden of Disease Study 2010 (GBD 2010) estimated 52 million cases of ASDs, equating to a prevalence of 7.6 per 1000 or one in 132 persons and the data were pooled using a Bayesian meta-regression approach.

Executive function (EF) is a broad term that refers to the cognitive processes that help us regulate, control and manage our thoughts and actions. It includes planning, working memory, attention, problem solving, verbal reasoning, inhibition, cognitive flexibility, initiation of actions and monitoring of actions.

Executive functions are brain activities that allow us to set goals, organize, and complete tasks. little children typically react to any stimulus they encounter in a manner that is impulsive, concrete and present-oriented.

Problems with executive function are neurological in nature and are thought to arise from a disruption or delay in normal neurological development. The pre-frontal cortex is considered to be largely responsible for executive function skills.

Many of these children do not progress well with social and communication issues. Children with Autism showed significant deficits in response inhibition, cognitive flexibility/switching and working memory (Blythe A. Corbett 2009).

The goals of executive function in occupational therapy are Organization, Working Memory, Self-monitoring, Task Initiation/ Planning and Prioritizing, Flexibility, Impulse/Emotional Control, Pro-social Skills and metacognition.

In 2005, M.C Goldberg examined the executive functions between Autism Spectrum disorder and ADHD, and they found that Autism spectrum disorder has more impairment mainly in spatial working memory than ADHD.

Exergaming or active gaming combines two very popular concepts, video games and fitness. There are going number of studies that support the positive effect of exergaming on health, fitness, coordination, anxiety and stress reduction as well as social and cognitive

and problem solving skills. The single greatest advantage, active gaming has over traditional forms of exercise that it is not just a physical activity but also a form of entertainment. As a result the level of motivation to stick with the exercise program is also much higher than with traditional exercise. The interactive aspect of exergaming like competition, attention to details in the virtual environment, the need for participants to anticipate events and make decisions and have a very positive effect on executive functioning as well as attention, working memory, planning, multi- tasking and problem solving skills.

Participating in the exergame called the makoto arena helps to improve the neural connections in the brains of the ASD children. Occupational therapy and rehabilitation sciences department concludes that exergaming specifically the makoto arena has the potential to serve as a valuable addition to therapies for children with autism spectrum disorder for motor and executive function impairments.

In this study the researcher intend to find out the effectiveness of exergame on executive function among Autistic children.

Need for the Study

Autism is a neuro developmental disorder characterized by impaired social interaction, verbal and non-verbal communication, and restricted and repetitive behavior. Autism children have problems in executive function like difficulty in organizing and remembering steps, insufficient impulses, planning memory, attending, sustaining, shifting, initiation, emotional control and reaction speed, mental and physical endurance. They are few studies to improve executive function of autistic children by using the game called exergame (Makoto arena). Though lots of studies are done in other countries, but there is no evidence in India, hence new attempt has been made in this research.

Operational definition

Autism

Autism is a complex developmental disability, signs typically appear during early childhood and affect a child's ability to communicate, and interact with others.

Exergames (Makoto arena)

A Makoto court consists of three metal beams arranged in an equilateral triangle on the floor. At each corner of the triangle there is a six-foot-tall column, equipped with a speaker. Each column has twelve targets which have pressure sensors. The concept of the game is, listen for the tone, look for the light, hit the target. The games are used as a therapeutic tool for building visual, cardiovascular and neurological performance.

Executive function

Executive functions are skills to plan, organize and complete tasks. Executive functions are brain-based cognitive skills that facilitate critical thinking and self-regulation. Executive functions to help with goal-setting and decision making. These skills include flexibility, focus, organization, planning, self-awareness, self-control, time management, and working memory, reaction speed, mental and physical endurance and motor control.

AIMS & OBJECTIVES

AIM

The aim of the study is to find out the effectiveness of Exergame (Modified makoto arena) on executive function of Autistic children.

OBJECTIVE

- To screen the Autism children using Indian scale for assessment of Autism.
- To assess the executive function of Autistic children by using "Behaviour Rating Inventory Executive Function (BRIEF)".
- To evaluate the effect of exergame (Modified makoto arena) on executive function of Autistic children.

HYPOTHESIS

Alternate hypothesis

Effect of Exergame (Modified makoto arena) will have significant effect in improving executive function in Autism**.**

Null hypothesis

Effect of Exergame (Modified makoto arena) will have no significant effect in improving executive function in autism.

RELATED LITERATURE

The history of Autism

The word "autism," which has been in use for about 100 years, comes from the Greek word "autos," meaning "self." The term describes conditions in which a person is removed from social interaction hence, an isolated self.

In the 1940s, researchers in the United States began to use the term "autism" to describe children with emotional or social problems. Leo Kanner, a doctor from Johns Hopkins University, used it to describe the withdrawn behavior of several children he studied. From the 1960s through the 1970s, research into treatments for autism focused on medications such as LSD, electric shock, and behavioral change techniques. The latter relied on pain and punishment.

During the 1980s and 1990s, the role of behavioral therapy and the use of highly controlled learning environments emerged as the primary treatments for many forms of autism and related conditions. Currently, the cornerstones of autism therapy are behavioral therapy and language therapy. Other treatments are added as needed.

DEFINITION

Autism is a complex neurobehavioral condition that includes impairments in social interaction and developmental language and communication skills combined with rigid, repetitive behaviors.

SYMPTOMS

Autism typically appears during the first three years of life. Some children show signs from birth. Others seem to develop normally at first, only to slip suddenly into symptoms when they are 18 to 36 months old.

The symptoms are impairments in social interaction and communication & restricted repetitive and stereotyped patterns of behavior, interests and activities.

GLOBAL PREVALENCE

- About 1 in 68 children has been identified with autism according to estimates from CDC's Autism and Developmental Disabilities Monitoring (ADDM) Network.
- Autism is reported to occur in all racial, ethnic, and socioeconomic groups.

- Autism is about 4.5 times more common among boys (1 in 42) than among girls (1 in 189).
- Studies in Asia, Europe, and North America have identified individuals with Autism with an average prevalence of between 1% and 2%.
- A 2012 review of global prevalence estimates of autism spectrum disorders found a median of 62 cases per 10,000 people.

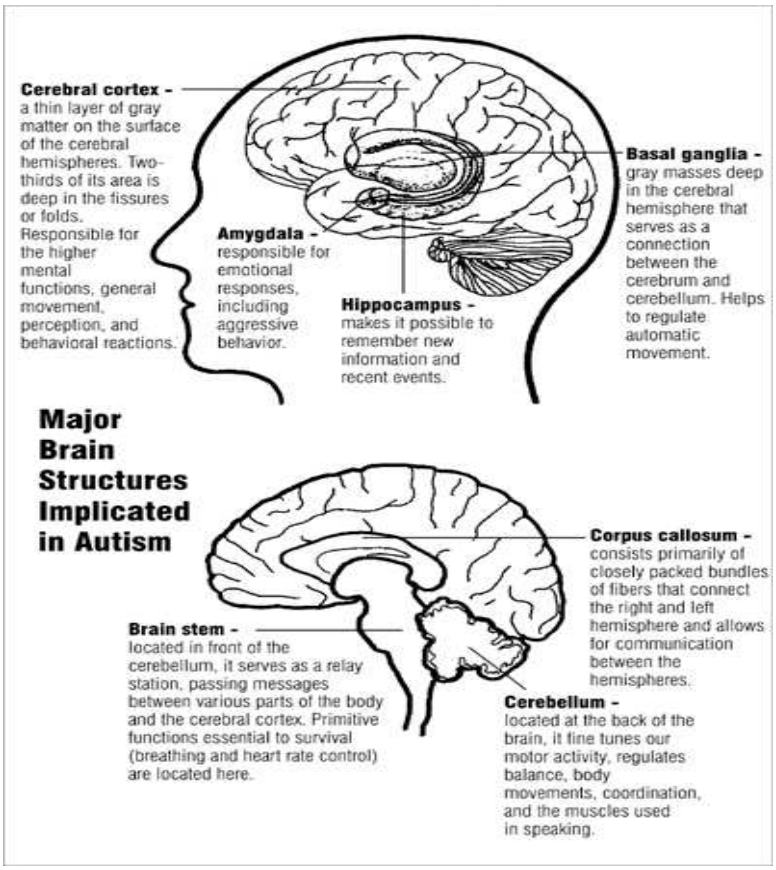
Pathophysiology

- Neuroanatomical studies and the associations with teratogens strongly suggest that autism's mechanism includes alteration of brain development soon after conception. This anomaly appears to start a cascade of pathological events in the brain that are significantly influenced by environmental factors.
- The immune system is thought to play an important role in autism. Children with autism have been found by researchers to have inflammation of both the peripheral and central immune systems as indicated by increased levels of pro-inflammatory cytokines and significant activation of microglia. Biomarkers of abnormal immune function have also been associated with increased

impairments in behaviours that are characteristic of the core features of autism such as deficits in social interactions and communication. Interactions between the immune system and the nervous system begin early during the embryonic stage of life, and successful neurodevelopment depends on a balanced immune response. It is thought that activation of a pregnant mother's immune system such as from environmental toxicants or infection can contribute to causing autism through causing a disruption of brain development.

- The mirror neuron system (MNS) theory of autism hypothesizes that distortion in the development of the MNS interferes with imitation and leads to autism's core features of social impairment and communication difficulties.

- Several studies have tested this hypothesis by demonstrating structural abnormalities in MNS regions of individuals with Autism, delay in the activation in the core circuit for imitation in individuals with Asperge’s syndrome, and a correlation between reduced MNS activity and severity of the syndrome in children with Autism.



CAUSES

- The exact cause of Autism is currently unknown.
- It's a complex condition and may occur as a result of genetic predisposition (a natural tendency), environmental or unknown factors.

Genes

- Most researchers believe that certain genes a child inherits from their parents could make them more vulnerable to developing Autism.

- Cases of Autism have been known to run in families. For example, younger siblings of children with Autism can also develop the condition, and it's common for identical twins to both develop Autism.
- No specific genes linked to Autism have been identified, but it may be a presenting feature of some rare genetic syndromes, including Fragile X syndrome, Williams syndrome and Angelman syndrome.

Environmental triggers

- Some researchers believe that a person born with a genetic vulnerability to Autism only develops the condition if they're exposed to a specific environmental trigger.
- Possible triggers include being born prematurely (before 35 weeks of pregnancy), or being exposed in the womb to alcohol or to certain medication, such as sodium valproate (sometimes used to treat epilepsy during pregnancy).
- No conclusive evidence has been found linking pollution or maternal infections in pregnancy with an increased risk of Autism.

Autism and vaccines

- One of the greatest controversies in autism is centered on whether a link exists between autism and certain childhood vaccines, particularly the measles-mumps-rubella (MMR) vaccine. Despite extensive research, no reliable study has shown a link between autism and the MMR vaccine.

ONSET OF DURATION

It should possible to detect autism symptoms before one year of age, at least for children with early onset autism. Screening tools should focus on the social communication skills that infants display between 6-12 months, such as looking, vocalizing, and smiling at others.

Diagnostic criteria

DSM-5 Criteria for Autism Spectrum Disorder

Currently, or by history, must meet criteria A, B, C, and D

A. Persistent deficits in social communication and social interaction across contexts, not accounted for by general developmental delays, and manifest by all 3 of the following.

1. Deficits in social-emotional reciprocity.

2. Deficits in nonverbal communicative behaviors used for social interaction.

3. Deficits in developing and maintaining relationships.

B. Restricted, repetitive patterns of behavior, interests, or activities as manifested by at least two of the following:

1. Stereotyped or repetitive speech, motor movements, or use of objects.

2. Excessive adherence to routines, ritualized patterns of verbal or nonverbal behavior, or excessive resistance to change.

3. Highly restricted, fixated interests that is abnormal in intensity or focus.

4. Hyper-or hypo-reactivity to sensory input or unusual interest in sensory aspects of environment;

C. Symptoms must be present in early childhood (but may not become fully manifest until social demands exceed limited capacities.

D. Symptoms together limit and impair everyday functioning.

MANAGEMENT

Pharmacotherapy

- No pharmacologic agent is effective in the treatment of the core behavioral manifestations of autistic disorder, but drugs may be effective in treating associated behavioral problems and comorbid disorders (eg, self-injurious behaviors, movement disorders).
- Second-generation antipsychotics (eg, risperidone, aripiprazole, ziprasidone)
- SSRI antidepressants (eg, fluoxetine, citalopram, escitalopram) Stimulants (eg, methylphenidate).

Nonpharmacologic therapy

- Behaviour modification
- Sensory integration techniques
- Social skill training
- Cognitive behaviour modification
- Family counselling
- Relaxation techniques
- Integrative medicine

BEHAVIOUR MODIFICATION

Various studies have shown that behavioural modification therapies are more successful when the child has an active role in deciding on the program, its goals and incentives. Behavioral modification is effective if strictly applied and should be directed at correcting everything that is abnormal in the child's behavior, and that is potentially correctable. It is based on the principles of operant conditioning and social learning.

- Positive reinforcement
- Negative reinforcement
- Punishment

SENSORY INTEGRATIVE TECHNIQUE

Sensory integration therapy, as practiced by occupational therapists, uses play activities in ways designed to change how the brain reacts to touch, sound, sight and movement.

Techniques

1.Calming techniques: These help to relax the nervous system

Techniques: Warm bath, deep pressure massage back rub using comfort touch, joint compression, stretches, bean bag, large pillows and blanket

wrap (Neutral warmth). Firm pressure and skin to skin contact, slow rocking, slow swinging, progressive muscle relaxation, quite music with steady beat, finger hugs and hugging teddy bear.

2. Organizing techniques: It can help to focus attention.

Techniques: Using curly straws, hard candy, vibration- use a vibrating pillow, pushing, pulling, hanging or lifting heavy objects, chewing, blowing, swimming, adding rhythm to activities.

3. Altering techniques: It can help a child who is under (or) over reaction sensory input, passive (or) lethargic become more focused and attentive.

Techniques: Bright lighting and fresh cool air, fast swinging, bouncing as a ball, strong down (perfume, peppermint etc), visually stimulating room, fast and sudden noises.

Treatment activities

- Vestibular based activities: swimming, bouncing etc.
- Proprioceptive based activities: Weighted object, climbing activities using ropes, ladder, and ramps etc.
- Tactile based activities: Brushing, slow stroking of spine, sand activities etc.

- Oral motor activities: Blow bubbles, chewing activities, suck thick liquids through straw etc.

Joint compression techniques

- Hand to elbow: elbow hold hand is leave shake position, stabilize elbow and quickly press hand back into direction of elbow.
- Elbow to shoulder : shoulder stabilize elbow and quick pressed down at shoulder.
- Hip to knee
- Knee to feet
- Finger to elbow, stabilize palm and quickly pull out and finger
- Shoulder –press down on both shoulder
- For the final step, apply three quick compression on chest, pressing down and back against the sternum, stabilize are hand on back.

Precaution :

Never brush on the face and stomach.

Environment and structure

- Minimize visual and auditory stimuli
- Reduce clutter: in both the room and on learner's desk
- Restrict visual field-screen three side of learner's desk

- Reduce mobile or suspended equipments in treatment area.
- Paint walls colours- calming effect
- Slanted desk top improve focus
- Make physical contact to get child's attention
- Desk top activities
- Punch bag-for reinforce acceptable behaviour.

SOCIAL SKILL TRAINING

Social skill training is a form of behaviour therapy used by teachers, therapist and trainers to help persons who have difficulties relating to other people.

Techniques: Modeling, Role playing, Shaping, Feedback, Reinforcement of positive interactions, Visualization, Prompts.

COGNITIVE BEHAVIOUR MODIFICATION AND SELF CONTROL

The techniques include:

- Verbal modification
- Modeling
- Contingency management techniques
- Cognitive self-control training

FAMILY COUNSELLING

For family counseling to be effective everyone in the family needs to understand as much as possible about ASD. It will help to read books and perhaps joint support groups. The aim of family counseling is to help the other members of the household to understand and better cope with the child's behaviour. For example, the parents may be instructed on various management techniques (such as time out) and how to balance punishments and rewards communication skills and anger management techniques are also useful.

RELAXATION TECHNIQUES

It can help everyone deal with stress and anxiety usually children with high level of stress. Sensory integration techniques can be used to adapt the traditional progressive relaxation programme. Tactile and proprioceptive programme can easily added to programme and can enhance success by increase sensory feedback.

- Hold the ball and squeeze tight and let it relax
- Make a monster face & let to relax
- Squeeze the ball with or shoulder and let it to relax
- Hold on breath & blow out.

Integrative medicine

Melatonin

- More than half of all children with autism spectrum disorder (ASD) struggle with sleep disorders – insomnia being the most common. Melatonin is a naturally occurring hormone that helps regulate the sleep-wake cycle. Supplements have been found to improve sleep and reduce insomnia in children with autism.
- Very small amounts of it are found in foods such as meats, grains, fruits, and vegetables. You can also buy it as a supplement.

Omega-3 Fatty Acids

- Fatty acids are essential for the development and function of the brain. Omega-3 fatty acids are popular nutritional supplements and widely considered safe.
- omega-3 fatty acid supplements may reduce autism-related symptoms such as repetitive behaviour and hyperactivity, as well as improve socialization.

EXECUTIVE FUNCTION

- Executive function skills are the mental processes that enable us to plan, focus attention, remember instructions, and juggle multiple tasks successfully.

- Executive functions (also known as cognitive control and supervisory attentional system) are a set of cognitive processes – including attentional control, inhibitory control, working memory, and cognitive flexibility, as well as reasoning, problem solving, and planning – that are necessary for the cognitive control of behavior, selecting and successfully monitoring behaviors that facilitate the attainment of chosen goals.

- Cognitive control and stimulus control, which is associated with operant and classical conditioning, represent opposite processes (i.e., internal Vs. external or environmental, respectively) that compete over the control of an individual's elicited behaviours, in particular, inhibitory control is necessary for overriding stimulus-driven behavioral responses (i.e., stimulus control of behavior).

- The prefrontal cortex is necessary but not solely sufficient for executive functions, e.g., the caudate nucleus and subthalamic nucleus are also involved in the inhibitory control of behavior.

- When children have opportunities to develop executive function, individuals and society experience lifelong benefits. These skills are crucial for learning and development. They also enable positive behavior and allow us to make healthy choices for ourselves and our families.

DEVELOPMENT OF EXECUTIVE FUNCTION

Developmental stages : Two to three years

- Beginning of symbolic thinking, points to pictures in books in response to verbal cue, object permanence, some may use single words, receptive language more advanced than expressive language.
- Uses more complex toys and understands sequence of putting toys, puzzles together.

Developmental stages : Three to four years

- Poor understanding of time, value, sequence of events Vivid imaginations, some difficulty separating fantasy from reality Accurate memory, but more suggestible than older children.
- Don’t realize others have different perspective Leave out important facts May misinterpret visual cues of emotions.

Developmental stages : Five years

- Can recognize others' perspectives
- Can't assume the role of the other.

Signs of executive function deficit

- Forgetting tasks and homework.
- Trouble starting homework independently.
- Estimating how long a task will take
- Being distracted easily.
- Difficulty keeping track of belongings.
- Inability to remember names and other key details.
- Trouble listening to and following instructions.
- Moving on to another task before one is finished.
- Difficulty remembering and following multi-step instructions.
- Problems understanding roles in multi-part organizations, like sports teams.
- Trouble transitioning between tasks.

Occupational Therapy Intervention for Executive Function

- Developmental frame of reference – it emphasizes the continuous modification and emergence of skills with age.

- Aquisitional frame of reference – the therapist shapes the behaviors that contribute to skill acquistion, the goal of intervention.
- Fine motor activities – Manipulative skills, finger plays, art, craft.
- Gross motor activities – Obstacle course, music dancing, overhead activities.
- Visual perception activities – Drawing, cutting.

EXERGAMES

Exergaming or **Exer-gaming**, or **gamercising** is a term used for video games that are also a form of exercise. Exergaming relies on technology that tracks body movement or reaction. Research indicates that exergames can produce real improvements in fitness. Exergames are seen as evolving from technology changes aimed at making video games more fun.

Exergames are video games that involve, or are specifically designed to encourage, some form of exercise and physical activity on the part of the player. These can be games made for fitness purposes or simply games for fun that also incorporate physical activity that can provide an excellent workout routine while playing them.

Effectiveness

- **Energy expenditure**

Energy expenditure during exergames differs only slightly from other traditional light-to-moderate intensity physical activities. Exergames which only require upper body movement typically result in energy expenditures equivalent to light physical activity, while lower and whole body movement games provide activity of at least a moderate intensity.

- **Heart rate**

Exergames increase heart rate compared to resting. Those which require whole/lower body movement produce a greater increase in heart rate than those which use only upper body movements.

- **Body composition and BMI**

Few exergaming studies have examined actual changes in body composition over time. For example, it has been suggested that if exergaming were to take place at a similar intensity outside the laboratory, children would have the potential to lose 2.5 kg-6 kg over the course of a year with only 15–30 minutes of game play per day.

- **Psychological outcomes**

Children and young people report enjoying Wii Fit activities more than inactive games and treadmill exercise.

Makoto Arena

- The Makoto Arena is a triangle with durable 6-feet steel towers rising from each corner. The smaller arena has a distance of 6’ between towers and Each tower is electronically wired to emit sounds and lights; the lights can occur randomly in any of 16 locations per tower. Hear it, see it, hit the lights.

- And the Makoto Arena is accessible for wheelchair users. A Makoto Arena experience combines cross-body movements with visual and auditory stimulus, and studies show significant improvement in visual, cardiovascular, and neurological performance with use of the arena.

Uses of Makoto

- Special needs/Autism/ADD/ADHD and more - the arena is used to improve visual, cardiovascular, and neurological performance.

- Educators and professionals who work with clients with learning challenges and autism. The Makoto Arena is accessible to people wheel chairs.

- Medical & Rehabilitation - combine physical fitness with brain fitness for stroke rehab and traumatic brain injury, speech therapy and more. The Makoto Arena is accessible to people who use wheelchairs.

- Youth fitness - kids play because it is fun and get benefits that go beyond physical activity.

REVIEW OF LITERATURE

Allison Attal et.al (2015)[2], The study investigated the use of a speed-based exergame, Makoto arena as an intervention strategy to improve Executive function and motor performance in children & adolescents with ASD. 17 school-aged children were selected to participate in the study and the results indicated that all areas of Executive Function was improved, assessed by using Behavior Rating Inventory of Executive Function and all motor skills was improved by Bruininks-Oseretsky Test of Motor Proficiency. This study found that use of exergaming is beneficial in improving Executive Function and motor performance in ASD.

Diane Collins (2015)[11] **et.al.,** This study examines the use of exergaming in improving physical and mental fitness for children with Autism spectrum disorder. 17 high functioning ASD were included. Results showed improvement in speed, executive function & motor skills. Hence the use of exergaming is effective in improving physical and mental fitness for Autism Spectrum Disorder.

Leung RC, Vogan VM et.al (Mar 3, 2015)[22], The study examined the relationship between executive function measured by the Behavioral Rating Inventory of Executive Functioning (BRIEF), and

social impairment measured by the Social Responsiveness Scale (SRS) and Autism is measured by the Autism diagnostic observation schedule. 70 children were included for the study. Findings showed that executive processes predicted social function in all children but not in typically developing children.

Baxter AJ et.al., (2015)[4]**,** The aim of the study to develop global and regional prevalence models and was to estimate the global burden of disease of ASDs for the Global Burden of Disease Study 2010 and the data were pooled using a Bayesian meta-regression approach. The results revealed that, In 2010 there were an estimated 52 million cases of ASDs, equating to a prevalence of 7.6 per 1000 or one in 132 person.

Hilton CL, (2014)[9]**,** This study was done to assess Exergame training intervention, a light and sound speed-based exergame, on response speed, Executive Function, and motor skills in school-aged children with ASD. There was a strong correlation between executive function and motor scores with the effect size of = 1.18. Significant improvement was seen in the Executive Function areas of working memory and metacognition and the motor area of strength and agility and they proved the use of exergaming, specifically the Exergame, is a

standard intervention for children with ASD who have motor and Executive Function impairments.

Rachel M. Flynn et.al (2014)[33], The study was conducted to find out the effect of exergame in executive function in children and Adolescents. 70 children in the age range of 10-16years participated in the 30 minutes exergame play sessions. Children who played the exergame over the course of five weeks demonstrated improvements in Executive Function skills. Additionally, children who played for more sessions experienced larger growth in Executive Function.

Navid Mirzakhany (2016)[29] **et.al.,** The study investigated the efficacy of structured play on the executive functioning in 5- to 12-year-old children with high-functioning autism and the study included 24 children. Behavior Rating Inventory of Executive Function was used. Structured play was taught to the experimental group. Results shows structured play was effective in improving executive function among high functioning Autism.

Satabdi Chakraborty et.al (2015)[39]**,** The study evaluated the Indian Scale for Assessment of Autism in relation to the Childhood Autism Rating Scale (CARS) and the Developmental Disability-Children Global Assessment Scale (DD-CGAS). Indian children with

diagnoses of Autistic disorder (AD, *n* = 50), Intellectual Disability (ID, *n* = 50), Attention Deficit Hyperactivity Disorder (ADHD, *n* = 26), other psychiatric disorders (PD-N=25) and control children without psychiatric disorders (*n* = 65) were evaluated using IASS, DD-CGAS & CARS. Statistical Analyses showed Indian Scale for Assessment of Autism scores were significantly different across diagnostic groups and Total Indian Scale for Assessment of Autism scores were significantly higher among children diagnosed with autistic disorder. The study concluded that IASS can thus be used to assess severity of AD among Indian children.

Kawther Salman Dawood et.al (2015)[20]**,** The study was done to assess the autistic child behavior. The behavior of autistic child was assessed using the Indian Scale for Assessment of Autism (ISAA). The results indicated that half of children reported a moderate level of the total score of behavioral problems for all domains. All autistic children displayed the same behavioral disorders with different levels of severity.

Blijd-Hoogewys EM et.al (2014 Dec)[6], This study evaluated the executive function of three autism subgroups, according to DSM criteria. Autistic disorder (N=35), Asperger's disorder (N=27) and PDD (N=65). 5 to 18 years old children were included in the study, children

was assessed using BRIEF. Finally, it is recommended, BRIEF profile has unique characteristic to consider validity index in children with ASD children.

Gilotty L, Kenworthy L et.al (2002)[14]**,** This study examined the relationship between executive abilities and adaptive behavior with Autism Spectrum Disorders, the Vineland Adaptive Behavior Scales (VABS) and the Behavior Rating Inventory of Executive Function (BRIEF) was used. Results found several relationships, The Initiation and Working Memory domains were negatively correlated with most domains of adaptive behavior. Also, the Communication and Socialization domains of the VABS were negatively correlated with several areas of executive functioning, suggesting that impairments in executive abilities are strongly associated with the deficits in communication, play and social relationships found in children with autism.

Best, John R (Sep 2012)[5]**,** The study examined the importance of exergaming in improving executive function. This study compares physical activity (Exergame) and cognitive engagement. 33 children in the age range of 6 to 10 years old participated in both physical and cognitive engagement activities. Result showed more precisely that physical activity (Exergame) influences executive function.

James W. Tanaka (2010)[17] et.al., The study examined the use of computer games on face recognition skills among Children with Autism spectrum disorder. Children who were significantly impaired in their face processing abilities were assigned. Children in the treatment group (N = 42) received 20 hours of face training with the *Let's Face It!* (*LFI!*) computer-based intervention**.** These results indicate measurable improvements in the face recognition skills of children with autism.

Sally Robinson (2009)[38] et al., This study examined executive functions in a group of children with ASD, in 108 participated in the study and the age range of 8;0–17;0 years; Full Scale IQ (FSIQ) 70–130 with that of control group. Results showed difficulties in planning, the inhibition of prepotent responses and self-monitoring reflecting characteristic features of ASD.

Haichun Sun (23 Jan 2013)[15], This study explored the impact of exergaming on in-class physical activity (PA) and motivation in Elementary school children. The children participated in a 4-week exergaming unit and a 4-week fitness unit. Results indicated that students' situational interest in exergaming was significantly higher than in the fitness unit at the beginning and end of instruction. The evidence

suggests that exergames may have strong motivational power receive health benefits in physical education.

Susan Faja, et.al. (2016)[41], This study examined executive function and play skills abilities in two groups namely higher initial language and lower initial language ability. For the higher language group, children develop play ability at age of 6 and above, but early play did not predict later executive function, whereas lower language group, cognitive ability contributed most to individual differences in executive function and play skills. And the results indicated that early executive function skills may be critical in order for verbal children with autism to develop play.

Liane B Azevedo, et.al (2014 Sep)[23]**,** This study experiment to examine the effect of introducing the dance mat exergaming systems on physical activity and health-related outcomes in 11–13 year old students using a non-randomised controlled design and mixed methods from five schools in intervention districts and two schools in neighbouring control districts. The implementation of a dance mat exergaming scheme was associated with improvement in anthropometric measurements and parameters of health-related quality of life. The mechanisms of these benefits are unclear as there was insufficient data from physical activity to draw conclusions.

METHODOLOGY

Research Design

The Present study was two groups, control & experimental with pre & post test, Quasi experimental design.

Control group(pre-test) —OT Intervention——Post test

Experimental group(post test) —OT intervention+ Exergame——post test

Variables

Independent variable : Exergame

Dependent variable : Executive function and Autism

Setting and duration of the study

The study was conducted in two different places, Aathichudy special school, Adyar, chennai for experimental group and Swapna therapy centre, Adyar, chennai for control group (July- September).

Sample Size: (30 subjects)

- 15 subjects for control group
- 15 subjects for experimental group

Sampling technique:

Convenient sampling procedure was adopted.

SELECTION CRITERIA

Inclusion criteria

- Children with Mild Autism
- Indian scale for assessment of Autism (70 to 106)
- Children of both genders
- Children between age of 5- 10yrs

Exclusion criteria

- Moderate & Severe Autism
- Behavioural Problems
- Autism with deaf and dumb
- The age below 5 yrs and above 10yrs are excluded
- Autism children with physical disabilities, Other Developmental & neurological conditions like Learning Disability, Brain Injury, ADHD, Low Birth Weight, Tourette's disorder.

Measurement tool & Materials used

Measurement tools

The tool used for the study is “Indian scale for assessment of Autism” for screening the Autism and “Behaviour Rating Inventory of Executive function” for assessing the executive function in Autism children.

Description of scale

Indian scale for assessment of Autism

This scale was based on CARS and has 40 items divided under six domains–social relationship and reciprocity; emotional responsiveness; speech, language and communication; behavior patterns; sensory aspects and cognitive component.

The items are rated from 1 to 5, increasing score indicating increasing severity of the problem.

A score of <70 indicates no autism, 70-106 (mild autism), 107-153 (moderate autism), and >153 (severe autism).

Age group of subjects

3 years and above

Time to administer

20-30 minutes

Reliability and validity

Inter-rater reliability ($r > 0.83$)

Test-retest reliability($r > 0.89$)

Sensitivity – 93.3 % Specificity- 97.4 %

Behaviour Rating Inventory Executive Function (BRIEF)

Author, is Gerard Giouia, Peter Isquith, Steven guy, dated 2000

The Behavioural Rating Inventory of Executive Function is an 86-item ecological rating scale (parent, teacher) designed to reflect the neuropsychological constructs of Executive Function in everyday situations for children age 5 to 18years.

Internal consistency, test–retest reliability (.72–.84). BRIEF requires 10-15 minutes to administer; 15-20 minutes to score by hand, software available for scoring and interpretation. Scoring is given 1,2,3 for the characteristics of never, sometimes, often respectively.

BRIEF has gotten both convergent and divergent validity, as well as high internal consistency ($\alpha = 0.8$-0.98) and the test-retest reliability which was 0.82 and 0.88 for parent and teacher forms, respectively.

There were also moderate correlations between teacher and parent ratings (r = 0.32-0.34).

PROCEDURE

Modified makoto arena consists of three metal beams(zing sheet) arranged in a equilateral triangle on floor. The height of the metal sheet is 5 feet, and gap between each metal beams is also 5 feet. The top of three metal beams are connected with each other for stability. 12 LED bulbs are attached on the metal beam in different places. Each metal beam consists of 4 LED bulbs which are of different colors, white, blue, yellow, and red. when the child switch on the button that is fixed in a beam the circuit starts, automatically the light of different colors with sounds comes from other beams, the child has to listen to the light and the sound and the child has to touch the light. when the child touches the light it will switch off. Children has to wear athletic shoes when perform the game for safety purpose.

A total of 30 subjects were taken in this study. The subjects were selected in the age group of 5-10 years.

The 30 subjects were divided into two groups, a control group and an experimental group, that is 15 in control group and 15 in experimental group.

The control group received only Occupational Therapy Management and the experimental group received Occupational Therapy Management and Exergame.

The pre test was conducted for both groups before the interventions by using Behaviour Rating Inventory of Executive Functions and Indian scale for assessment of Autism. Indian scale for assessment of autism was used to screen the Autism Children and Behaviour Rating Inventory of Executive function is used to assess the executive function in Autism children. Children in the experimental group were given physical guidance initially to perform the game. children received 3 times per session totally 90 times to complete 30 sessions, 3 sessions per week. Initially the game began with slowest speed and increased to next faster speed level, untill the child mastered the previous speed. (i.e 120 seconds was initially given, gradually the time is reduced).

Post test data were collected after the treatment sessions by using Behaviour Rating Inventory of Executive function. The pre test and post test data were used to find out the result of the study.

DATA ANALYSIS & INTERPRETATION

TABLE-1

COMPARISON BETWEEN PRE TEST VALUES OF CONTROL GROUP AND EXPERIMENTAL GROUP IN EXECUTIVE FUNCTION

SI. No.	Pre Test	Mean	M.D	S.D	"t" value	"p" value
1	Control group	218.8	0.2000	24.742	0.02213	P>0.05
2	Experimental group	218.6		24.767		

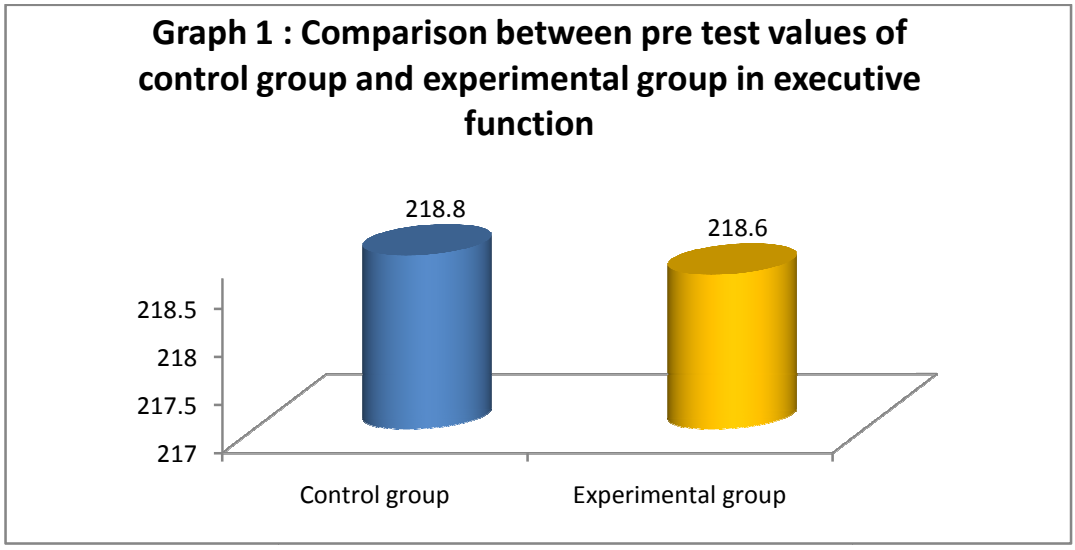


Table 1 and graph 1 shows the comparison between pre-test mean values of control group and experimental group. The mean values are 218.8, 218.6 and 't' value is 0.02213 and 'p' value is P>0.05 which shows it is not statistically significant.

TABLE-2

COMPARISON BETWEEN PRE AND POST TEST VALUES OF CONTROL GROUP.

Sl. No.	Control Group	MEAN	M.D	S.D	"t" value	"p" value
1.	Pre test	218.8	0.333	24.74	2.646	P<0.05
2.	Post test	219.13		24.71		

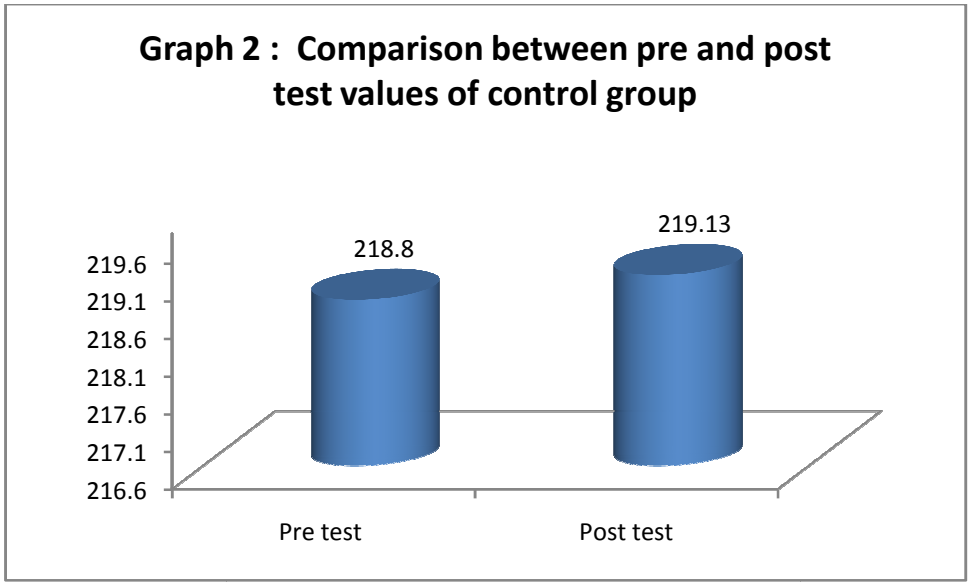


Table 2 and graph 2 shows that comparison between the pre-test and post test values of control group. The mean values are 218.8, 219.13 and 't' value is 2.646 and 'p' value is <0.05 which shows it is statistically significant.

TABLE-3

COMPARISON BETWEEN PRE AND POST TEST VALUES OF EXPERIMENTAL GROUP

Sl. No.	Experimental group	Mean	M.D	S.D	"t" value	"p" Value
1	Pre test	218.6	18.933	24.76	5.989	P<0.05
2	Post test	199.66		19.05		

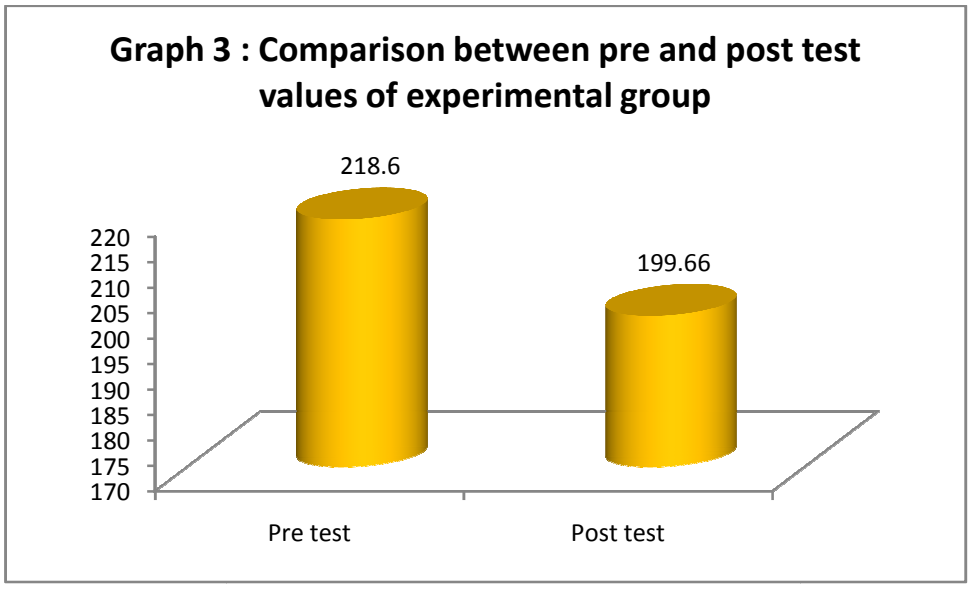


Table 3 and graph 3 shows that comparison between pre-test and post-test values of experimental group, the mean values are 218.6,199.66 and 't' value is 5.989 and 'p' value is <0.05, which shows it is extremely statistically significant.

TABLE-4

COMPARISON BETWEEN POST TEST VALUES OF CONTROL AND EXPERIMENTAL GROUP IN EXECUTIVE FUNCTION

Sl. No.	Executive Function	Mean	M.D	S.D	"t" value	"p" value
1	Post Test(CG)	219.13	19.467	24.718	2.416	P<0.05
2	Post test(EG)	199.66		19.059		

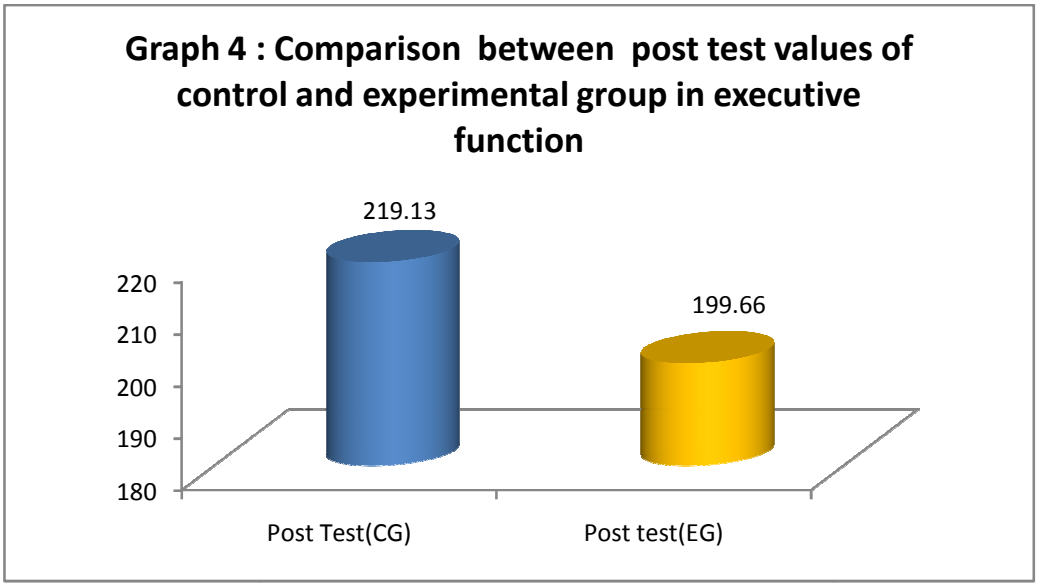


Table 4 and graph 4 shows that comparison between post-test values of control and experimental group. The mean values are 219.13, 199.66 and 't' value is 2.416 and 'P' value is < 0.05, which shows it is statistically significant.

DISCUSSION

The purpose of this study was to find out the effectiveness of Exergame on improving executive function in Autistic children. The aim of this study was to improve the executive function of Autistic children**.**

In this study exergame and occupational therapy treatment was given to the experimental group whereas the control group received only Occupational therapy. The exergame are given to improve the executive function of Autistic children. Children received exergame 3 times per session totally 90 times in 30 sessions, 3 sessions a week. Indian scale for assessment of Autism, was used to screen the Autistic children and the Behaviour Rating Inventory of Executive function, was used to evaluate the executive function. After the 30 sessions post test data was collected.

Table 1 shows that comparison between pre test values of control and experimental group. The mean values are 218.8(control) and 218.6 (Experimental) respectively and 't' value is 0.02213 and 'p' value is $p > 0.05$ and corresponding table value is 2.05. Since the calculated 't' value is lesser than table value which shows it is not statistically significant and there is no difference between pre test of control and

experimental group. It denotes the subjects in control and experimental group shows nearly same level of impairment in Executive function.

Table 2 shows that comparison between pre test and post test values of control group. The mean of pre test values was found to be 218.8 and the post test was 219.13 and 't' value is 2.646 and 'p' value is <0.05 and the corresponding table value is 2.15,since the calculated 't' value is greater than the table value which shows it is statistically significant and there is a difference between pre and post test values of control group. This result was supported by Navid Mirzakhany (2015), it was found that structured play was effective in improving executive function among high functioning Autism.

Table 3 shows that comparison between pre and post test values of experimental group. The mean of pre test values was found to be 218.6, 199.66 and 't' value is 5.989 and 'p' value is < 0.05 and the corresponding table value is 2.15, since the calculated 't' value is greater than the table value shows it is statistically significant and there is a difference between pre and post test values of experimental group. This result was supported by Hilton CL (2014), they found that Exergame (makoto arena) is a standard intervention for children with ASD who have motor and executive function impairments.

Table 4 and shows that comparison between of post test of control and experimental group. Mean values are 219.13 (control) and 199.66 (experimental) respectively. Since the calculated 't' test is 2.416 and 'p' value 0.05 and corresponding table value is found to be 2.05. Since the calculated 't' value is greater than table value which shows it is statistically significant and there is a difference between post test of control and experimental group. These findings are consistent that of Diane Collins (2015) who found that there was improvement in the executive function and mental fitness in children following the Exergame.

The present study has demonstrated that the children in experimental group who received exergame shows more statistical significance than the control group. Therefore the present study rejecting the Null hypothesis and accepting the alternate hypothesis. The results supports a tentative conclusion that exergame is a factor in the improvement of executive function in Autism. Based on the result, Exergame can be used as a treatment in improving Executive function among Autism.

CONCLUSION

From this study, it is concluded that there is a significant improvement in Executive function of the children with Autism through Exergame (Modified makoto arena).

The result of this study indicates that children with Autism who received Exergame (Modified makoto arena) and Occupational Therapy Intervention showed more improvement in Executive function. The children enjoy the programme and it improves their activity level and performance.

LIMITATIONS & RECOMMENDATIONS

LIMITATIONS

- The study was limited to smaller sample size
- The study was limited upto Mild Autism
- Study was conducted for shorter duration
- The study was limited to 5 to 10 years
- Male & female comparison is not included in this study.

RECOMMENDATIONS

- Study can be extended to other age groups
- The time period and sample size can be increased for conducting the therapy session.
- The study can be extended to people, who have executive skills difficulties associated with other disorders such ADHD, Learning disability etc.

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APPENDIX

APPENDIX – I

BRIEF SCALE FOR EXECUTIVE FUNCTION

1 = Occasionally; 2 = Often; 3 = Very Often

1	Overreacts to small problems	1	2	3
2	When given three things to do, remembers only the first or last	1	2	3
3	Is not a self starter	1	2	3
4	Cannot get disappointment, scolding or insult off his/her mind	1	2	3
5	Resist o has trouble accepting a different way to solve a problem with school work, friends, chores etc.	1	2	3
6	Becomes upset with new situations	1	2	3
7	Has explosive, angry outbursts	1	2	3
8	Has a short attention span	1	2	3
9	Needs to be told “no” or “stop that”	1	2	3
10	Needs to be told to begin a task even when willing	1	2	3
11	Loses lunch box, lunch money, permission slips, homework etc.	1	2	3
12	Does not bring homework, assignment sheets, materials etc.	1	2	3
13	Acts upset by a change in plan	1	2	3
14	Is disturbed by change of teacher or class	1	2	3
15	Does not check work for mistake	1	2	3

16	Cannot find clothes, glasses, shoes, toys, books, pencil etc.	1	2	3
17	Has good ideas but cannot get them on paper	1	2	3
18	Has trouble concentrating on chores, schoolwork, etc.	1	2	3
19	Does not show creativity in solving a problem	1	2	3
20	Backpack is disorganized	1	2	3
21	Is easily distracted by noise, activity, sights, etc.	1	2	3
22	Makes careless errors	1	2	3
23	Forgets to hand in homework, even when completed	1	2	3
24	Resists change of routine, foods, places, etc.	1	2	3
25	Has trouble with chores or task that have more than one step	1	2	3
26	Has outbursts for little reason	1	2	3
27	Mood changes frequently	1	2	3
28	Needs help from adults to stay on task	1	2	3
29	Gets caught up in details and misses the big picture	1	2	3
30	Has trouble getting used to new situations (classes, groups, friends)	1	2	3
31	Forgets what he/she was doing	1	2	3
32	When sent to get something, forgets what he/she supposed to get	1	2	3
33	Is unaware of how his/her behaviour affects or bothers others	1	2	3
34	Has problem coming up with different ways of solving a problem	1	2	3

35	Has good ideas but does not get job done (lacks follow -through)	1	2	3
36	Leaves work incomplete	1	2	3
37	Becomes overwhelmed by large assignments	1	2	3
38	Does not think before doing	1	2	3
39	Has trouble finishing task (chores, homework)	1	2	3
40	Thinks too much about the same topic	1	2	3
41	Underestimates time needed to finish tasks	1	2	3
42	Interrupts others	1	2	3
43	Is impulsive	1	2	3
44	Does not notice when his/her behaviour causes negative reactions	1	2	3
45	Gets out of seat at the wrong times	1	2	3
46	Is unaware of own behaviour when in a group	1	2	3
47	Gets out of control more than friends	1	2	3
48	Reacts more strongly to situations than other children	1	2	3
49	Starts assignments or chores at the last minute	1	2	3
50	Has trouble getting started on home work or chores	1	2	3
51	Mood is easily influenced by the situation	1	2	3
52	Does not plan ahead for school assignments	1	2	3
53	Gets stuck on one topic or activity	1	2	3
54	Has poor understanding of own strengths and weakness	1	2	3
55	Talks or play too loudly	1	2	3
56	Written work is poorly organized	1	2	3

57	Acts too wild or “out of control”	1	2	3
58	Has trouble putting the brakes on his or her actions	1	2	3
59	Gets in trouble if not supervised by an adult	1	2	3
60	Has trouble numbering things, even for a few minutes	1	2	3
61	Work is sloppy	1	2	3
62	After having a problem, will stay disappointed for a long time	1	2	3
63	Does not take initiative	1	2	3
64	Angry or tearful outburst are intense but end suddenly	1	2	3
65	Does not realize that certain actions bother others	1	2	3
66	Small events trigger big reactions	1	2	3
67	Cannot find things in room or school desk	1	2	3
68	Leaves a trail of belongings wherever he/she goes	1	2	3
69	Does not think consequences before acting	1	2	3
70	Has trouble thinking of a different way to solve a problem when stuck	1	2	3
71	Leaves messes that others have to clean up	1	2	3
72	Becomes upset too easily	1	2	3
73	Has a messy desk	1	2	3
74	Has trouble waiting for turn	1	2	3
75	Does not connect doing tonight’s homework with grade	1	2	3
76	Tests poorly even when knows correct answer	1	2	3
77	Does not finish long term project	1	2	3
78	Has poor handwriting	1	2	3

79	Has to be closely supervised	1	2	3
80	Has trouble moving from one activity to another	1	2	3
81	Is fidgety	1	2	3
82	Cannot stay on the same topic when talking	1	2	3
83	Blurts things out	1	2	3
84	Says the same thing over and over	1	2	3
85	Talks at the wrong time	1	2	3
86	Does not come prepared for class	1	2	3

APPENDIX – II

INDIAN SCALE FOR ASSESSMENT OF AUTISM

S. No.	Items	Rarely up to 20% score 1	Sometimes 21-40% Score 2	Frequently 41-60% Score 3	Mostly 61-80% Score 4	Always 81-100% Score 5
	SOCIAL RELATIONSHIP AND RECIPROCITY					
1	Has poor eye contact					
2	Lacks social smile					
3	Remains aloof					
4	Does not reach out to others					
5	Unable to relate to people					
6	Unable to respond to social /environmental cues					
7	Engages in solitary and repetitive play activities					
8	Unable to take turns in social interaction					
9	Does not maintain peer					
	EMOTIONAL RESPONSIVENESS					
10	Shows inappropriate emotional response					

11	Shows exaggerated emotions					
12	Engages in self-stimulating emotions					
13	Lacks fear of danger					
14	Excited or agitated for no apparent reason					
	SPEECH-LANGUAGE AND COMMUNICATION					
15	Acquired speech and lose it					
16	Has difficulty in using non-verbal language or gestures to communicate					
17	Engages in stereotyped and repetitive use of language					
18	Engages in echolalic speech					
19	Produces infantile squeals/unusual noises					
20	Unable to initiate or sustain conversation with others					
21	Uses jargon or meaningless words					

22	Uses pronoun reversals					
23	Unable to grasp pragmatics of communication (real meaning)					
	BEHAVIOUR PATTERNS					
24	Engages in stereotyped and repetitive motor mannerisms					
25	Shows attachment to inanimate objects					
26	Shows hyperactivity/ restlessness					
27	Exhibits aggressive behaviour					
28	Throws temper tantrums					
29	Engages in self-injuries behaviour					
30	Insists on sameness					
	SENSORY ASPECTS					
31	Unusually sensitive to sensory stimuli					
32	Stares into space for long periods of time					
33	Has difficulty in tracking objects					

34	Has unusual to pain					
35	Insensitive to pain					
36	Responds to objects/people unusually by smelling touching or tasting					
	COGNITIVE COMPONENT					
37	Inconsistent attention and concentration					
38	Shows delay in responding					
39	Has unusual memory of some kind					
40	Has ‘savant’ ability					

Classification	No autism < 70	Mild autism 70 – 106	Moderate autism 107 - 153	Severe autism > 153
Total Score				

APPENDIX – III

MASTER CHART

CONTROL GROUP

Sub. Code		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Age		7	6	7	7	8	9	8	7	8	10	9	5	6	6	5
Sex		M	M	M	F	M	F	M	F	F	M	M	M	F	M	M
Indian Scale		169	123	161	163	110	129	158	150	109	133	169	140	147	153	147
BRIEF	Pre test	213	191	236	229	252	241	182	203	242	187	209	237	254	218	188
	Post test	213	192	237	230	252	242	182	203	242	188	209	237	254	218	188

EXPERIMENTAL GROUP

Sub. Code		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Age		7	6	7	7	8	9	8	7	8	10	9	5	6	6	5
Sex		M	M	M	F	M	F	M	F	F	M	M	M	F	M	M
Indian Scale		151	102	149	150	106	105	146	131	101	124	152	129	131	124	116
BRIEF	Pre test	215	194	239	232	233	236	185	203	241	180	209	239	247	222	184
	Post test	209	187	213	207	219	202	178	191	237	171	192	221	202	197	169

APPENDIX – IV

CONSENT FORM

Informed Consent

I have been informed about the study, “Effectiveness of Exergame on Executive Function of Autistic Children” and have been invited to participate in the same. I have been informed about the importance of the study. I have understood that I have the right to refuse my consent at any time. I have read this consent form and have been given the opportunity to ask questions.

The contents of this consent form were read out and explained to me in the local language in which I am conversant and I have signed this document after having understood the contents completely.

I ……, the undersigned, give my consent for participation on my own accord.

Signature/thumb impression of participant

Name:

Pace:

DESCRIPTION OF STUDY

ABSTRACT

OBJECTIVE

The purpose of the study was to evaluate the Effectiveness of Exergame on Executive function of Autistic children.

METHODS

Totally 30 subjects, 15 in experimental group and 15 in control group with age of 5-10 years participated in current study.

RESULTS

Statistical significance is present in experimental group than control group with regard to effectiveness of Exergame(Modified makoto arena) with Occupational Therapy intervention.

CONCLUSION

Exergame (Modified makoto arena) has an significant effect on improving Executive functions.

KEYWORDS

Autism, Executive function, Exergame (Modified Makoto arena), Occupational therapy intervention

CONFIDENTIALITY

Your name will not be associated with the results in this study. It will be issued for both teaching and research purpose. Only myself and my guide will have access to the name of the subjects participating in this study.

The following is the name address and telephone number of the person to be contacted in event of research related inquiry.

Name : M.Sumathi

Address : JKKMMRF College of Occupational Therapy
Komarapalayam, Namakkal Dt.

CONCERN TO PARTICIPATE VOLUNTARY
IN A RESEARCH INVESTIGATION

NAME **:**

AGE **:**

SEX **:**

ADDRESS FOR COMMUNICATION **:**

DECLARATION

I have fully understood the nature and purpose of the study. I accept my child to be a subject in this study. I declare that the above information is true to my knowledge.

Signature of the informant

Date :

Place :